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Literature Review

Guided Inquiry Based Teaching Module to Improve Students' Learning Outcomes and Curiosity: A Literature Review

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Abstract

Physics learning in schools often remains dominated by conventional, teacher-centered approaches, limiting students' opportunities to explore concepts and develop curiosity. This condition contributes to low learning outcomes and weak conceptual understanding. This study aims to analyze how guided inquiry-based learning modules can improve students' curiosity and learning outcomes. The method used was a literature review by examining 50 Sinta 2-5 indexed articles published between 2017 and 2025. Then, 10 of the most relevant articles were selected for in-depth analysis. The results of the study indicate that the steps of inquiry observing, asking, formulating hypotheses, exploring, and concluding consistently foster students' curiosity and increase their engagement in the learning process. In addition, all articles reported significant improvements in learning outcomes, demonstrated by increases in grades, conceptual understanding, and moderate to high n-gain. In conclusion, inquiry-based learning modules are valid, practical, and highly effective teaching materials in improving students' curiosity and learning outcomes.

Keywords: Curiosity, Guided Inquiry, Learning Outcomes, Teaching Modules.

1. Introduction

The development of innovative teaching modules has become a crucial need in enhancing the quality of science education, particularly physics, which requires the active engagement of students in the scientific thinking process. In practice, various studies indicate that classroom learning is still dominated by conventional, teacher-centered strategies. Consequently, students have fewer opportunities to explore concepts, cultivate curiosity, and build knowledge through direct experience. This condition impacts the low learning outcomes and conceptual understanding of students (Ulfa et al., 2024; Siung et al., 2023). Within the context of the Merdeka Curriculum, which emphasizes meaningful and exploratory learning, the inquiry approach is considered highly relevant as it encourages students to independently observe, question, collect data, and draw conclusions.

A synthesis of the 50 articles reviewed in this study shows that the use of inquiry approaches whether guided inquiry, structured inquiry, or bounded inquiry lab consistently has a positive impact on increasing student curiosity, critical thinking skills, learning outcomes, and scientific literacy. Hasanah et al. (2019) and Komalasari et al. (2019), confirm that inquiry-based teaching modules can facilitate students in understanding abstract concepts and developing science process skills. Similar findings also emerge from studies on various topics such as fluid mechanics, global warming, motion dynamics, vectors, energy, and chemistry concepts, where inquiry modules have proven to improve students' analytical

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abilities and learning independence (Astuti & Olensia, 2019; Idamayanti et al., 2025; Rahma & Azhar, 2021).

Overall, the examination of these 50 articles reinforces that the inquiry approach is an effective learning model aligned with the demands of modern education. This approach not only improves learning outcomes but also plays a vital role in fostering curiosity and shaping scientific thinking skills in students. Therefore, this literature review is compiled to provide a comprehensive overview of the effectiveness of the inquiry approach as a theoretical foundation for developing inquiry-based teaching modules on measurement uncertainty and other physics topics.

Although numerous studies have reported the effectiveness of inquiry-based learning in improving student learning outcomes, most of these studies have focused on the development and implementation of inquiry models in specific classroom contexts. Previous literature reviews have tended to discuss inquiry learning in general terms without providing a focused synthesis of guided inquiry-based teaching modules that explicitly examine students' learning outcomes and curiosity in the context of the Independent Curriculum. Therefore, this literature review addresses this gap by systematically analyzing selected empirical studies to highlight how guided inquiry-based teaching modules contribute to improving students' curiosity and learning outcomes, and to identify key design characteristics that support effective science learning.

2. Methods

The method used in this research is a Literature Review, which is the process of gathering, selecting, and analyzing various scientific articles relevant to a specific topic. This approach is used to understand research trends and the effectiveness of inquiry-based teaching modules in improving student learning outcomes and curiosity. The use of a Literature Review aligns with the research by Rahma & Azhar (2021) which examined the feasibility of an inquiry-based colloid module through an in-depth analysis of validation results and trials, as well as research by Masithah et al. (2022) which developed an inquiry e-module and assessed its effectiveness through systematic evaluation.

The data collection procedure began by examining the 50 articles listed in the review document, then selecting the 10 The selection of ten articles for in-depth analysis was based on strict inclusion criteria, including relevance to guided inquiry-based teaching modules, clarity of research methodology, and explicit measurement of learning outcomes and/or students' curiosity. These articles were considered representative because they provided comprehensive empirical evidence regarding module validity, practicality, and effectiveness, allowing for a focused and meaningful synthesis of findings by Hasanah et al. (2019).

Data analysis was conducted using content analysis techniques, which involve reading, identifying, and categorizing the main findings from each article. This technique was also used by Ariesandi et al. (2021) in exploring teachers' needs for inquiry-based electronic modules as a basis for developing teaching materials. Through this analysis, the researcher evaluated the module development model, product feasibility, the impact of module use, and the improvement in student learning outcomes and curiosity. A synthesis stage was then carried out to conclude important patterns emerging from all articles, thereby obtaining a comprehensive picture of the effectiveness of inquiry-based teaching modules in the context of science learning.

3. Results and Discussion

3.1. Research Results

The results of this study are based on the research question regarding how guided inquiry-based teaching modules can increase student curiosity and learning outcomes. Based on the reviewed articles, the researcher compiled the following table to facilitate analysis of the contribution of guided inquiry-based teaching modules to improving learning quality. This table contains the 10 most relevant and comprehensive articles representing the main research trends in the field of inquiry module development.

Table 1. Articles on the relationship between teaching modules, guided inquiry, learning outcomes, and curiosity

Code	Research Title	Research Findings
P1	*Pengembangan Modul Berbasis Inkuiri Terbimbing pada Materi Kimia untuk Meningkatkan Keterampilan Proses Sains* (Nensi, 2024)	The module was declared very feasible based on content expert validity (87.81%) and media expert validity (91.39%). Students' science process skills increased from 62.29% to 83.33% after using the module. The module provides complete inquiry steps (formulating problems - concluding), thereby significantly improving scientific abilities and student curiosity.
P2	*Pengembangan E-Modul Laju Reaksi Berbasis Inkuiri Terbimbing Terintegrasi Virtual Laboratory Untuk SMA/ MA* (Gevi & Andromeda, 2019)	The e-module is highly valid (content kappa 0.89; technical 0.83). Practicality is high (teachers 0.82; students 0.91). Integration of virtual lab and inquiry steps makes students more active in experimenting, understanding concepts, and learning independently. The average conceptual understanding reached 82.63%. The module improves learning outcomes, independence, and students' exploratory interest.
P3	*Pengembangan Bahan Ajar IPA Berbasis Inkuiri Terbimbing untuk Meningkatkan Literasi Sains* (Komalasari et al., 2019)	Scientific literacy increased (N-gain 0.70). The module is very feasible and student responses are positive (77.8%). Effective in improving scientific skills.
P4	*Pengembangan Modul Ajar Berbasis Inkuiry Terbimbing* (Gumay & Syabawaihi, 2024)	The module is valid and practical. Learning outcomes increased based on t-test. Students better understood temperature-heat concepts and were more active in discussions.
P5	*Pengembangan Modul IPA Terpadu Berbasis Inkuiri Terbimbing dengan Tema Barbeque Kelas VII SMP Negeri 1 Tawangmangu* (Nugraheni et al., 2015)	The module increased motivation, curiosity, and learning independence. Inquiry activities made students more interested in conducting experiments and scientific discussions.
P6	*Bahan Ajar IPA Berbasis Inkuiri Untuk Meningkatkan Literasi Sains* (Masithah et al., 2022)	The module proven to improve scientific literacy and student inquiry activities. Learning becomes more meaningful through observing, questioning, and concluding activities.
P7	*Pengembangan E-Modul Termokimia Berbasis Inkuiri Terbimbing Terintegrasi Virtual Laboratory untuk SMA/MA* (Nofrida & Andromeda, 2019)	The e-module is highly effective in increasing student curiosity and motivation. Observation and experiment activities make students more active and learning outcomes improve.
P8	*Analisis Kebutuhan Pengembangan Modul Elektronik Berbasis Inkuiri untuk Meningkatkan Kemampuan Berpikir Komputasi pada Materi*	Teachers need inquiry-based e-modules. Analysis results show that modules can improve learning effectiveness and student independence.

	Barisan dan Deret Siswa SMA (Ariesandi et al., 2021)	
P9	*Pengembangan Modul Kimia Analitik Berbasis Inkuiri pada Materi Titrasi* (Astuti & Olensia, 2019)	The module increases curiosity and understanding of environmental concepts. Student activity rose during the investigation process.
P10	*Pengembangan Perangkat Pembelajaran Berbasis Inkuiri Terbimbing untuk Meningkatkan Kemandirian Belajar dan Hasil Belajar Peserta Didik pada Materi Asam Basa* (Yunus et al., 2023)	The e-module declared very feasible, increasing learning interest. Students more easily understood colloid concepts and were more active in analysis.

3.2. Discussion

This discussion focuses on interpreting the findings from the 10 core articles summarized in Table 1, as they provide the most relevant empirical evidence regarding the effectiveness of inquiry-based learning modules. Meanwhile, the 50 articles reviewed in the initial phase of the research were used as context to map general research trends, rather than as the primary basis for in-depth analysis, to avoid ambiguity between the scope and focus of the analysis.

When viewed collectively, the ten core articles demonstrate a strong consensus of findings that inquiry-based learning modules both guided and structured consistently have a positive impact on students' learning outcomes, curiosity, independent learning, and conceptual understanding. This commonality of findings suggests that the effectiveness of the inquiry approach is not solely a result of a specific context or material, but rather stems from the systematic integration of scientific steps into the learning process.

One key pattern emerging from Table 1 is that the success of inquiry modules is closely related to the quality of their design and development process. Most studies developed modules using R&D models such as 4D, ADDIE, and Borg & Gall, with an emphasis on validity, practicality, and effectiveness testing before classroom implementation. These findings indicate that an inquiry-based approach will deliver optimal impact when supported by a structured learning design and a rigorous evaluation process.

In terms of learning outcomes, all ten articles consistently demonstrated that inquiry-based learning modules promote active learning and student cognitive engagement (Ulfa et al., 2024; Siung et al., 2023). This demonstrates that inquiry-based modules developed within the context of the Independent Curriculum and contextual learning are capable of improving students' active participation and physics learning outcomes. Interpreted collectively, these findings confirm that the inquiry approach is effective because it positions students as active subjects in the knowledge construction process, not simply recipients of information. In addition to improving learning outcomes, several articles in Table 1 also demonstrate agreement on improving students' scientific literacy and scientific activity (Hasanah et al., 2019; Komalasari et al., 2019).

Consistently, the use of inquiry-based teaching materials improves students' scientific literacy skills. This suggests that inquiry modules impact not only conceptual mastery but also the development of scientific thinking skills, the primary goal of science education. While no significant contradictions in findings were found between studies, an analysis of the ten core articles revealed variations in the emphasis on learning outcomes based on educational level and the material taught. Yunus et al. (2023) emphasizes increasing learning independence and learning outcomes through guided inquiry-based e-modules, while Agustin (2017) focuses more on increasing the activeness and conceptual understanding of elementary school students. At the high school level, Nensi (2024) demonstrated improved science process skills

as the primary outcome of implementing the inquiry module. This variation does not indicate differences in effectiveness, but rather indicates that the inquiry module is flexible and adaptable to different learning needs.

The cross-article analysis also revealed a research gap that warrants attention. Most studies still focus on measuring short-term impacts, such as improved learning outcomes and curiosity after module implementation. Research on the long-term sustainability of the inquiry module's impact and the transfer of scientific thinking skills to other learning contexts remains limited. This gap highlights the need for further research examining the effectiveness of inquiry modules longitudinally and across contexts.

Overall, the synthesis of findings from these ten core articles indicates that inquiry-based learning modules are effective because they integrate scientific processes into learning in a planned and meaningful manner. This discussion not only summarizes previous research findings but also emphasizes that the primary strength of inquiry modules lies in their ability to foster active learning, curiosity, and student learning independence, which aligns with the goals of science education and the demands of the Independent Curriculum.

4. Conclusion

Based on a detailed analysis of the ten core studies presented in results and discussion, this literature review concludes that guided inquiry-based instructional modules demonstrate consistent effectiveness in improving the quality of science learning. The empirical evidence indicates that the analyzed modules are generally reported to be valid and practical, and their implementation results in measurable improvements in student learning outcomes, including higher test scores, improved conceptual understanding, and moderate to high n-gain values.

Beyond cognitive gains, the synthesis of findings reveals that the systematic implementation of the steps of inquiry including observing, questioning, formulating hypotheses, conducting investigations, and drawing conclusions plays a critical role in fostering students' curiosity, scientific literacy, and independent learning. These results highlight that inquiry-based instructional modules support not only content mastery but also the development of essential scientific thinking skills.

Furthermore, the analysis demonstrates that the effectiveness of guided inquiry-based modules is not limited to a specific educational level or subject area. The reviewed studies demonstrate successful implementation across a variety of elementary, middle, and high school contexts, indicating the adaptability of inquiry-based modules to diverse learning objectives. Therefore, this review provides evidence-based support for the use of guided inquiry-based instructional modules as a robust learning approach aligned with the principles of meaningful learning and the demands of contemporary science education.

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